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THE DISSENTERS

The NFL rolled out Paper Number 5 in *Neurosurgery* in November 2004. By then, the league's Mild Traumatic Brain Injury Committee had moved well beyond concussion videos and crash-test dummies. With each new study, the NFL was mounting a scientific argument. In essence, that argument amounted to this: Don't worry, be happy. Concussion rates in the NFL are extraordinarily low. The number of concussions is a meaningless predictor of future injuries; theoretically, one can have an infinite number of concussions and still be fine. There is no link between football and brain damage because football players don't get brain damage. To those on the other side of the argument, there was a kind of ham-fisted logic about this science of denial. NFL Commissioner Paul Tagliabue had created a research arm that exactly mirrored his skepticism about the so-called concussion crisis.

NFL Paper Number 5 dealt with the modest 8 percent of players who had missed at least one game because of a concussion, described by Pellman and his colleagues as "the most severely injured of the NFL concussion cases." Who were these players, and what happened to them? To start with, they were mostly quarterbacks, defensive backs, wide receivers, and kick returners "injured in high-speed, high-acceleration collisions." Although this observation ignored the violence taking place in the Pit, it made some sense. The players on the perimeter were being hit with extraordinary force. It stood to reason that the most spectacular

collisions were likely to result in the most severe injuries. Quarterbacks, who were often exposed and used their brains more than any other players, were perhaps most sensitive to the effects of concussions, as seen in the cases of Aikman, Young, and many others. Not surprisingly, these players had more acute symptoms: lingering memory loss, disorientation, sensitivity to light, lethargy, and so on.

From there, Pellman and his colleagues went on to draw a number of conclusions that left some of the nation's leading concussion researchers shaking their heads in wonderment. One finding was that even these severely injured players recovered very quickly and, when they returned, were not at greater risk for further injury. This conclusion ran counter to nearly all previous research, which held that one concussion left you predisposed to another. But the NFL's logic was the same as in the previous studies: The fact that players went back on the field was an indication that they were fine; otherwise team medical personnel wouldn't have cleared them. It is perhaps germane to note again that nearly half of the NFL's concussion committee was made up of team doctors. Pellman, who was one, commended them for their superb diagnostic skills. He noted that only a small percentage of these players had been allowed back on the field the same day they suffered their injuries, an indication that "NFL team physicians and athletic trainers are extremely effective in screening out the most severely injured players on the sidelines within a short period of time after injury." NFL doctors might actually be "overly conservative and cautious," Pellman and his colleagues posited, in light of how quickly the players recovered and the risk of long-term brain damage—a risk that Pellman and his colleagues calculated was exactly zero:

"This 6-year study indicates that no NFL player experienced . . . cumulative chronic encephalopathy [brain damage] from repeat concussions. While the study did not follow players who left the NFL, the experience of the authors is that no NFL player has experienced these injuries."

The NFL hadn't actually *studied* retired players, but that didn't stop the league's experts from concluding that none had sustained long-term brain damage. Pellman and his colleagues would repeat this statement, in some form, over and over and over.

Except that not even the NFL believed it to be true.

The MTBI committee's controversial assertion that football didn't cause brain damage, which would create so much trouble for the NFL, was undermined by the league's quiet dealings with Webster and other injured veterans. At the same time the MTBI committee was publishing its research, Bob Fitzsimmons, Webster's lawyer, and a Baltimore attorney, Cy Smith, had taken the Bert Bell/Pete Rozelle NFL Player Retirement Plan to court to try to get more money for Pam Webster and the kids. The retirement board, of course, had determined in October 1999, while Webster was still alive, that he had had irreparable brain damage from repeat concussions related to his career. Webster's cognitive difficulties, the board wrote, were "the result of head injuries [he] suffered as a football player with the Pittsburgh Steelers and Kansas City Chiefs," a statement Fitzsimmons would describe as "the proverbial smoking gun." Now, over four years later, Pellman's committee—a separate entity but also under Tagliabue's control—was denying in a prestigious medical journal that such injuries were possible.

As Fitzsimmons and Smith pressed their lawsuit, they obtained confidential documents that showed, among other things, that it wasn't just Webster. The NFL retirement board had granted benefits to several other players with long-term brain damage. One was Gerry Sullivan, a contemporary and friend of Webster's who played guard and center for the Cleveland Browns from 1974 to 1981. Sullivan had the usual litany of NFL horror stories. On one occasion, during a punt return, he recalled plodding down the field to try to catch Oilers return man Billy "White Shoes" Johnson, which he equated with "trying to catch a rabbit." Sullivan was applauding himself for getting anywhere near White Shoes Johnson when another Oiler ear-holed him. "The first thing to hit the floor of the Astrodome was my head," Sullivan said. "Back then, they just had about a half inch of Grass-Tex—some kind of poly product that looked like grass—and then a slab of concrete. They peeled me off the field." The next thing Sullivan knew he was sitting on the bench, "vomiting on my jersey. Thankfully the Oilers had Earl Campbell. They had a really long sustained drive, and they were able to get me to where I was, you know, semi-functional." Sullivan sucked on an oxygen mask while a trainer asked him how many fingers he was holding up. "We were really kind of thin on the offensive line; that might have been the reason I went back in," he said.

When his career ended, Sullivan became chief operating officer of a company that leased automatic ice makers. A witty, self-deprecating man, he had been highly respected by his colleagues until, for no apparent reason, his moods began to vacillate between "manic hilarity and extreme anger," according to a letter the company's president wrote to the NFL retirement board. Sullivan threatened employees and punched holes in ice machines and walls. In 2005, based on the evaluations of several doctors, the retirement board awarded Sullivan "total and permanent" benefits related to his chronic brain injury.

Yet another document produced by the league showed that the same board had awarded permanent benefits to at least two other players whose doctors concluded they had gotten brain damage from playing pro football. The board redacted the names of those players, and the documents were stamped "confidential."

The longer the Webster lawsuit went on, the more evidence surfaced that the NFL had been handing out benefits to brain-damaged former players for years. To win, Fitzsimmons and Smith needed to prove that Webster's brain damage had left him disabled at the end of his career and not six years later, as the board had determined. This wasn't hard, because all five doctors who examined Webster—including Edward Westbrook, the neurologist brought in by the NFL—had attested to this. Still, the retirement board fought it all the way to the appellate court, which awarded $1.8 million in benefits and damages to Webster's family. The ruling stated flatly: "Mike Webster, the Hall of Fame center best known for anchoring the offensive line of the Pittsburgh Steelers professional football team from 1974 to 1988, developed brain damage as a result of the multiple head injuries he suffered as a player." The ruling noted caustically that the NFL retirement board had asked the court "to do two things: first, to disregard the testimony of the Board's own medical expert (in addition to *all* the others) . . . and, second, to hold that the *absence* of contemporaneous evidence is itself 'substantial evidence.' "

But perhaps most interesting about the 35-page ruling was a footnote on page 28 in which the court referred to "eight other cases of . . . disability due to brain damage." It was unclear who the players were—

the names were never disclosed—but the United States Court of Appeals for the Fourth Circuit clearly was aware of them. Of course, so was the NFL.

This was indeed a curious situation: two NFL committees, both involved in health matters, with completely opposite views on the subject of football and brain damage. The NFL retirement board, charged with dispensing disability benefits to deserving former players, was headed by the NFL commissioner (a nonvoting member served on his behalf) and was made up of three owners' and three players' reps. That board, which consulted with neurological experts around the country to render its decisions, had accepted long-term brain damage as a fact of NFL life for some players. Pellman's Mild Traumatic Brain Injury Committee, the NFL's research arm, had been formed by the same commissioner and reported directly to him. That committee stated unequivocally and repeatedly that NFL players didn't get brain damage. The MTBI committee went so far as to declare: "Professional football players do not sustain frequent repetitive blows to the brain on a regular basis."

At first, opposition to the MTBI committee was limited to a few scientists who tried to prevent this assertion and its dubious corollaries from appearing in the pages of *Neurosurgery*. They were, not coincidentally, the same neuroscientists whose research had warned that the league was facing a catastrophic health crisis.

One was Kevin Guskiewicz, the earnest young researcher studying retired NFL players at the University of North Carolina. Guskiewicz was respected as a thorough researcher and an honest broker even when concussion experts began to split into warring factions over the NFL. But Guskiewicz could hardly believe what was happening to him. From his earliest memories—riding a bike to watch the Steelers from a hill in Latrobe to taping Merril Hoge's ankles as an apprentice Steelers trainer—football was in Guskiewicz's blood. His three kids were playing Pop Warner. Guskiewicz had hoped his research on depression and dementia would help make the sport he loved safer. Instead, he found himself under attack. When Guskiewicz published his seminal depression study, which showed that players who sustained at least three concussions were far more likely to be clinically depressed later in life, Hank Feuer, the Colts' neurosurgeon and a member of the MTBI committee, dismissed it as "virtually worthless." The fact that it was merely a survey—the most comprehensive one of its kind in the history of the NFL—made it worthless, according to the league's doctors. "They didn't have information from the doctors confirming it," Ira Casson, the MTBI committee's neurologist, told the *New York Times*. "They didn't have tests, they didn't have examinations. They didn't have anything. They just kind of took people's words for it." (A decade later, Feuer would still describe Guskiewicz's study as "the worst type of research that you can publish.")

The crux of the NFL's argument was that players were more likely to come clean with their coaches and team doctors than with independent researchers. But the reverse, in fact, was true. Young and Hoge, after all, had pleaded with their coaches and team doctors to let them back on the field—even after the concussions that destroyed their careers. Hoge was so desperate that even after he was forced to retire, he called Joe Maroon at 2 A.M. to insist he could play. Numerous studies had shown that when athletes were asked directly by independent researchers, the incidence of concussions skyrocketed. Annual concussion rates in college were over 70 percent, and rates in the Canadian Football League were nearly 50 percent. Were NFL players' brains really that different?

Guskiewicz thought that what was going on was obvious: The NFL wasn't promulgating science; it was trying to protect its business. Later, when he was asked to deliver the commencement address at his alma mater, West Chester University, Guskiewicz described his stunning realization that rather than helping his favorite sport, his research had been perceived as "incriminating toward arguably one of the most popular and profitable industries in America." His findings were "the last thing the NFL wanted to hear," Guskiewicz told the graduates. The league went into "damage control mode," using its own scientists to try to "put out the fire" and discredit him. He dismissed the work of the NFL's committee as "industry-funded research at its best."

As the papers continued to roll out in *Neurosurgery*, Guskiewicz, who was one of the peer reviewers, savaged them. "Very suspect," he called the latest. But seemingly there was no stopping them. Bob Cantu, the Boston neurosurgeon who was serving as sports section editor of the journal, said he was equally opposed to the papers and tried to get them

killed. Like Guskiewicz, he had come to believe that the NFL's research arm had set itself up as protector of the league. "The feelings that we had from the articles were that the authors were being self-serving to the NFL and that's what the NFL wanted," Cantu said, "and that they would ingratiate themselves to the NFL if they essentially produced data that would make the NFL look good and, in the process, maybe solidify their positions with the NFL."

"The flaws were too great," Cantu said. "We didn't think they should be published."

But when Cantu went to Mike Apuzzo—the editor in chief and neurological consultant to the New York Giants—the response was always the same, he said. Apuzzo told him: "This is important information that readership wants to hear. I will give you and the other reviewers the opportunity at the end of the paper in the comments section to comment about the weaknesses of the paper and your negative feelings about it." But Cantu, like Guskiewicz, felt that was inadequate. "Nobody really seriously reads the comments at the end of the paper," he said. "And the person, no matter how bad the comments are, can simply say, 'Well, I got cited in a peer-reviewed journal that's very respected and prestigious.' The damage is done."

Cantu was 74 and had authored more than 350 scientific publications over 45 years by the time he was interviewed for this book. He said he had never seen another "instance where essentially the editor stepped in and went against what the reviewers' comments were."

Cantu felt Apuzzo's close relationship with Tagliabue and the NFL had influenced his judgment. "I know that Michael discussed meeting with the commissioner and how he enjoyed it, and I think that's totally appropriate," Cantu said. "But at the time he first mentioned that, it didn't dawn on me just how enamored with the whole thing maybe he was. Because as time would roll on there was one article after another of questionable accuracy."

But Cantu felt that wasn't all of what was going on. "I don't want to give the impression that [Apuzzo] was cherry-picking what went into the journal based on just his view of the NFL," he said. "I think he was letting NFL things in because he thought they were hot. They sizzled

and would sell the journal, and the journal would have a greater readership, a greater interest and drive because of it."

Under Apuzzo's editorial retrofit, *Neurosurgery* had effectively doubled in size. Total submissions rose 285 percent. Ad revenue increased dramatically. In his USC bio, Apuzzo wrote that reader penetration under his leadership "increased astronomically, from 6,000 in 1992 to 13 million in 2005," because the journal was bundled on a data platform with elite publications such as *JAMA* and the *New England Journal of Medicine*. Asked if he thought the NFL papers contributed to *Neurosurgery*'s success, Cantu replied: "I'm probably not in a position to know with certainty, but if I were to take a calculated guess, *immensely*." One reviewer described the NFL papers as "an irresistible read."

A USC spokeswoman initially offered to set up an interview with Apuzzo for this book, which, she wrote, "sounds like a great project." But when she contacted him, Apuzzo declined and said he did not believe his participation would "benefit him or the university," the spokeswoman wrote. Apuzzo did not respond to numerous e-mails and calls.

Cantu valued his position at Apuzzo's prestigious publication. For that reason, he said, he never threatened to resign when Apuzzo published the NFL's research over his objections. "I didn't go to the mat with the editor, in all honesty, because I felt that he would just strip me of being section editor," he said. "I liked being in that role, and I didn't really want to lose it. And I believed I would have lost it if I simply said, 'It's me or these articles.' "

"Oh, for God . . . Jesus," responded one former member of the MTBI committee when Cantu's remarks were read to him. "I mean, think about what you're saying here. He's the *section editor*. He's putting his name out there as a section editor. Right? And he's telling me that the general editor told him, 'You have to do this,' and he didn't make a ruckus? He didn't walk away? He's the man of great ethics, the man on the white horse?"

Others also felt Cantu was trying to have it both ways, trying to disavow science that he in fact commissioned and presided over. Another former MTBI member, interviewed during the 2012 election cycle,

called Cantu "the Mitt Romney of doctors. You can never pin the guy down. He flaps in the wind."

But there were distinct sides now to the NFL's concussion crisis. On one side was the National Football League, promoting the worldview that everything was fine. On the other side were neuroscientists such as Guskiewicz and Cantu and Bailes. That side was small but growing. Collectively, the researchers who stood up to the NFL became known as the Dissenters.

Up to that point, Mark Lovell had managed to steer clear of the controversy building around the NFL's committee. Armed with Tagliabue's letter of endorsement, he continued to travel the country, selling teams on his concussion test. By the mid-2000s, most had embraced it in some fashion. Lovell was the director of what had become known as the NFL Neuropsychology Program, a lofty title that he never bothered putting on business cards. He considered his presence on the MTBI committee a sideline, a perk on top of his main job running the sports concussion program at the University of Pittsburgh Medical Center. One of Lovell's favorite spots in the world was a retreat in Pennsylvania's Amish country where he'd often get away to write and reflect. The hideaway fit how he perceived himself: low key, with an innate desire to lie low.

That was all about to end.

Now Pellman and the MTBI committee wanted to gather the results of the NFL Neuropsychology Program and see what they said about the ability of pro football players to withstand concussions. Pellman, of course, had no background or expertise in neuropsychological testing. No matter. As head of the NFL's concussion committee, he again appointed himself lead author on the study. At this point, the conclusions of NFL Paper Number 6 would have surprised no one. It was all part of the same narrative. Pellman and his colleagues wrote that the results "corroborated" the league's earlier findings that NFL players "demonstrated a rapid recovery." NFL players also "did not demonstrate evidence of neurocognitive decline after multiple concussions," they wrote. The findings, finally, "support the authors' previous work, which indicated that there was no evidence of worsening injury or chronic cumulative effects of multiple MTBIs in NFL players." The response to the paper also was predictable: Guskiewicz, Cantu, and Bailes recommended killing it. Without that option, they spiced their appended comments with words like "unfortunate," "preliminary," and "premature."

But the criticism was about to take a more serious turn. Lovell, who signed off on the paper as a coauthor, would take a major hit. The league had gathered the data for the study from the network of neuropsychologists Lovell had spent years assembling. One was Bill Barr, the team neuropsychologist for the New York Jets. Barr by then had moved his practice to NYU Medical Center, where he was chief neuropsychologist at the Comprehensive Epilepsy Center. Barr viewed the Jets gig as something of a lark and a career builder. Each Sunday, he watched the game on TV. Whenever his wife tried to pry him off the couch, he'd respond: "Hey, I'm working here!" Most of the "psycho neurologists" around the country knew one another, so it wasn't surprising that Lovell also was acquainted with Barr. Their history wasn't totally amicable. In the 1990s, when Micky Collins was an up-and-coming researcher, Lovell and Barr both had recruited him as a research fellow. Collins had picked Lovell, to whom he remained devoted. "I never thought Bill forgave me or Micky for that," Lovell said. But Lovell and Barr had stayed on good terms, even publishing together. In 2004, the same year the NFL's treatise on neuropsychology came out, Lovell and Barr coauthored a chapter on American football in a textbook on brain injury in sports.

Barr worked as the Jets' neuropsychologist for nearly 10 years, at which point he ran afoul of Pellman and the NFL's concussion committee. On December 11, 2004, he appeared at a sports concussion conference at Madison Square Garden. He spoke about his own research, including his role in a two-part series he had recently coauthored with Guskiewicz and others in *JAMA*. One of the major findings was that one concussion increased the risk of another—the exact finding the NFL was trying to refute. Barr told the audience he was preparing another study on the optimal time to administer neuropsychological testing, which he concluded was 5 to 10 days after an injury. That, too, diverged from NFL policy, which under Pellman and Lovell was 24 to 48 hours.

A week later, Barr said he got a call from Pellman, who had not attended the conference. Pellman, as the NFL's medical director and

Jets doctor, oversaw Barr's work as the neuropsychologist for the team. Pellman said he heard that Barr had been "bad-mouthing" the NFL, according to Barr.

Barr told Pellman that he had merely described his own research. Pellman, according to Barr, responded by advising him that he'd have to clear all future concussion research through him, regardless of whether it was related to the NFL. Barr refused. He told Pellman that would compromise his integrity as a scientist and a faculty member at NYU.

"Then your time with the Jets is over," Pellman informed him, according to Barr. Pellman later would vehemently deny Barr's account to Peter Keating of ESPN, calling it "ridiculous."

Barr was still fuming a few months later when he heard that the NFL was about to release a paper based on data from the NFL neuropsychology program. His first thought was: "Are you kidding me? You're doing *what?* I haven't heard anybody talking about this data for years and now you're almost done with the paper?" Barr had accumulated hundreds of baseline tests while working for the Jets. He said neither Pellman nor Lovell asked him for the data. Barr said he contacted Pellman, who told him he excluded the Jets because of Pellman's role as team doctor. That made no sense, Barr protested, telling Pellman that leaving out the data would bias the study. "He kind of blew me off," said Barr. "He was like, 'No, no, no, I don't need the data. We're okay, we're gonna do it.'" Pellman later denied this conversation to ESPN's Keating, the first journalist to explore the NFL's adventures in concussion research. "Bill Barr was a consultant for the Jets who tested individual players to help us make decisions," Pellman told Keating. "I did not discuss the committee's research with him."

When Paper Number 6 came out, Barr thought something stank, particularly the statistics that Pellman and Lovell used to support the conclusion that everything was right with the NFL's world. The study reported that only 22 percent of concussed players—143 athletes—had submitted to neuropsychological testing. For a five-year study, that was an extremely low number. Why? Part of it was that the tests were voluntary; not all players were participating. But Barr knew that his own data for several years weren't included. Then, three months later, the *New York Times* published its report that Pellman had attended medical

school in Guadalajara, not New York, as he had told Congress. The *Times* hadn't connected Paper Number 6 and the credentials flap, but when Barr saw the story, he decided to dig deeper into the mystery of what had happened to his data. His central question was whether Pellman, with Lovell's assistance, was embroidering the NFL's science in the same way he had embroidered his résumé.

Barr began to contact other neuropsychologists from Lovell's network to see if he could find out whether their data had been excluded from the study.

On March 30, 2005, the day the *Times* published the Pellman piece, Barr wrote an e-mail to Rick Naugle, the neuropsychologist for the Cleveland Browns. "You might have seen this story in today's news," Barr began, attaching the link. He continued: "I have actually had some questions about the NFL study on neuropsychological testing that was published by Pellman and his colleagues last year in *Neurosurgery.* The number of reported baselines and injured players doesn't match up with what I would expect for the five year study period from 1996 to 2001."

Naugle replied that he sent Lovell data on "2 or 3 players." He added: "I have a few hundred baselines. Mark does not have those data."

Barr also wrote to Chris Randolph, a neuropsychologist for the Chicago Bears. Randolph said he had collected baselines for 287 players. No one from the committee had requested his data.

He wrote to John Woodard, the neuropsychologist for the Atlanta Falcons. Woodard had collected baseline tests for 173 players. He too was never asked for his data.

By the time Barr was done canvassing neuropsychologists from Lovell's network, he calculated that at least 850 baseline tests—and perhaps thousands more—had been excluded from the NFL's results. Barr was concerned that Pellman and Lovell had cherry-picked the data to reinforce the league's argument that the impact of concussions was negligible and players recovered quickly. Barr said Pellman called him one year before the paper came out looking for information on three former Jets: Kyle Brady, Fred Baxter, and Keyshawn Johnson. None had been with the team in years, but they had come back quickly from their concussions, and that fit the profile of the players who were reported on in the NFL's study. "I think they had an agenda on what they wanted to

find in the research before they conducted the research," said Barr. Pellman later told Keating this was false: "Team doctors talk to specialists and ask them for results all the time," he said. "It's part of their job."

Lovell denied that data were purposely excluded. He said that Naugle and Randolph had refused to provide data and that a "miscommunication" prevented Woodard from providing his. Barr, he said, later privately told the NFL that "we had all of his data on multiple occasions. So do we have it or do we not? I don't know. He's the only one who knows the answer to that." Lovell believed that Barr had launched his attack to get back at Pellman for firing him and that Lovell wound up as collateral damage.

Lovell's role in the controversy was bewildering. His pioneering research had helped expose the NFL's concussion problem. Leigh Steinberg had featured him in his seminars to convince the NFL the world was round. He had taken the witness stand to accuse the Chicago Bears of ruining Merril Hoge's career by failing to take his concussion seriously. Yet now many of his fellow neuroscientists suspected that Lovell was involved in the NFL's effort to cover up its concussion problem.

Lovell denied that was the case. "I don't think the NFL ever wanted to have a concussion problem. I don't think anybody ever does," he said. "But, I mean, the suggestion that there was some kind of grand conspiracy, I don't think, honestly, knowing the people on the committee—that never happened. Or none of us would have been involved with it."

Yet much of what the NFL believed about concussions was there in black and white, with Lovell's name attached to it. Beyond the allegations about the missing data, Lovell had put his name to research that concluded, among other things, that (1) concussions are minor injuries and nearly all NFL players recover quickly and completely and (2) pro football doesn't cause brain damage, *ever.* Oddly, Paper Number 6 even suggested that neuropsychological testing was at best of limited use in assessing football-related concussions and at worst useless. Was Lovell really bashing his own profession, the research that had come to define him? Even his partner Maroon seemed taken aback, noting in his review that "the authors seem to suggest that the role of neuropsychological testing is 'minor.' Such a strong statement does not seem to be justified."

Lovell, backpedaling years later, argued that he was a victim of the

inner workings of Pellman's committee, which he said produced the more inflammatory assertions without his knowledge. When the MTBI committee wrote up its findings, he said, it was a collaborative effort. Each author wrote a section related to his work. The sections were then compiled by the lead author, which in nearly all cases was Pellman. Lovell claimed that he contributed sections on the history of neuropsychology and football, the evolution of the NFL Neuropsychology Program, and the methodology of the study. His name was on the paper as a coauthor, but he claimed he didn't write the passages that produced the most controversy and, later, legal action.

Neuropsychology was of limited use in diagnosing concussions?

"Obviously I didn't write that," Lovell said.

Multiple concussions do not increase the risk of further injury?

"I didn't write that."

NFL players don't get brain damage?

"I didn't write that," Lovell said again. He acknowledged he could have protested to the committee to try to get the passages changed. But there was already a lot of back-and-forth between the authors, he said, and he didn't pay atttention to sections he didn't write. Lovell said the language was "actually softened a great deal."

"Could I have said, you know, 'God dammit!' " said Lovell. "Probably. Didn't."

One former committee member said it was essentially revisionist history for Lovell to try to disavow responsibility for a paper that, after all, had his name on it. Versions of the papers were indeed passed around among all the authors, the committee member said, and changes were made constantly upon request. "I wouldn't have any argument with someone saying, 'Gee, looking back on it, I wish I hadn't agreed to that,' " the former MTBI committee member said. "But to say, 'They put something in there that I didn't agree with'? Everyone had the opportunity to look at everything and had the chance to say, 'I don't agree with that, and I don't want to be an author on it, let's change it.' And it probably would have been changed."

It was an eventful four months for Elliot Pellman and his MTBI committee. Pellman had fired a neuroscientist who disagreed with the NFL's concussion policies; his own credentials had been exposed as

inaccurate and inflated; and he had published a controversial study that was based on questionable data.

In April 2005, Barr sent a letter to his dean at NYU "to clarify the nature of [the] professional relationship I have had with Dr. Pellman since the early 1990s and to review the series of events that ultimately led to the abrupt termination of this relationship."

He described how Pellman, after Barr refused to clear all research through the NFL, not only fired him but "threatened me with a lawsuit" if Barr ever tried to publish research related to his work with the Jets.

"The idea that someone would attempt to restrict my academic activity and prevent the communication of my research findings, as a precondition for continued employment, was most disturbing," Barr wrote. "I would appreciate it if you could keep this letter on file in the event that I have any further encounters with Dr. Pellman."

Barr would have future encounters with the NFL; that was certain.

Despite the work of the Dissenters, the NFL's concussion research machine was unstoppable. During one prolific stretch in 2004 and 2005, the league churned out five papers in as many months; the first four listed Pellman as lead author. The committee ultimately pumped out 16 papers on concussions, an extraordinary number for a single group of researchers publishing in one journal. Cantu, who commissioned the first paper for *Neurosurgery,* thought that it was overkill, that one or two studies would have sufficed: "For the life of me, to this day I don't understand how it turned into that many papers." But Apuzzo insisted on taking them all, he said. In February 2005, Maroon, one of the reviewers, wrote: "This article represents the seventh and final contribution by the NFL Committee on MTBI on the various aspects of head injury in professional football." Yet a month later, without explanation, there it was: Part 8! Some concussion researchers began to mock *Neurosurgery* as the "Official Medical Journal of the National Football League" or the "Journal of No NFL Concussions." No sooner would Guskiewicz review one paper than another would arrive in his in-box. Guskiewicz, of course, was rejecting the work. But oddly, Apuzzo would still call him, asking where his review was so that the paper could be published. "He'd say, 'You know, I'd really like to get this paper out,

because we're delayed and we're waiting on your commentary,' " said Guskiewicz. "And I'm like, 'Mike, you just sent it to me 10 days ago. You know, I've got a life.' "

"We all talked about this often: Who was driving this?" said Guskiewicz. "Who was pushing him? We never knew. It was just odd. And very questionable."

Whether it was Pellman who actually wrote the papers—9 out of 16 would list him as the lead author—also was unclear. Two former committee members insisted that none of the studies was ghostwritten, a not uncommon practice in the research community, but the idea that a rheumatologist with no experience in neuroscience could write that many papers on the subject struck many as unlikely. Pellman, after all, had never authored a paper on the topic before taking over as head of the MTBI committee, according to a search of PubMed, a database of scientific literature. Some seasoned researchers felt lucky to publish a paper or two a year. But the reassuring treatises kept coming. Pellman and the NFL now were saying that concussions were so minor that players were generally safe to return to the same game even if they had lost consciousness. Not only that, although the league had studied only NFL players, they wrote, "It might be safe for college/high school football players to be cleared to return to play on the same day as their injury." The authors suggested that "rather than blindly adhering to arbitrary, rigid guidelines, physicians keep an open mind to the possibility that the present analysis of professional football players may have relevance to college and high school players."

After a while, the Dissenters threw in the towel. If any assertion could be published unchallenged as peer-reviewed science in *Neurosurgery,* they reasoned, what was the point of peer reviewing the studies? "Quite frankly, people like Kevin and myself just quit reviewing these papers," said Cantu. "We just said, 'These are poorly written, you can't use this data to make the claims they're making, and we won't even bother to write comments anymore because it's just so flawed and so bad. We won't be a part of this.' "

"We were like, 'I'm outta here,' " said Guskiewicz. When Apuzzo sent him papers to review, Guskiewicz refused. Soon Apuzzo stopped asking. Cantu said Apuzzo's solution to the peer review uprising was not

to shut down the NFL's research but to find other reviewers who were willing to chime in.

Lovell continued to argue that he was on the outside of this unruly debate and that except for the three papers that had his name on them, he barely paid attention to the literature the MTBI committee was churning out every month. "I probably only read five of the papers," Lovell said. "Other than that I had absolutely nothing to do with the papers." That argument avoided one important fact: As a body of work, the papers were an expression of NFL dogma. Over and over, they repeated the same essential themes, making it nearly impossible to dissociate oneself from the overall message. Lovell was a coauthor on NFL Papers 3, 6, and 12; all asserted that NFL players didn't get brain damage from playing football and/or seemed to have superhuman qualities that limited their susceptibility to concussions. Paper Number 12 included the observation: "In our opinion, it is unlikely that athletes who rise to the level of the NFL are concussion prone."

"That's just kind of a stupid statement," Lovell said when it was read back to him. "What do you mean by 'concussion prone'? What does that mean? I didn't write it, but it's stupid either way."

"Well, your name's on it," it was pointed out.

"No, no, no," he said. "I mean, is my name on that sentence?"

The researchers associated with the NFL's work would all take a hit to their reputations, but Lovell in many ways had the farthest to fall. By the time he arrived on the committee, he had spent years helping athletes understand the seriousness of head trauma. He had helped bring concrete measurements to an injury that team trainers and doctors had only guessed at. Now Lovell found himself accused of carrying water for the NFL. Whether Lovell was a passive or an active participant in this stunning transformation was subject to interpretation. Lovell argued that he was merely swept up in the politics of the committee but played a very minor role. "I'm not a, you know, NFL company man," he said. "Do I regret some of the things that were said that had my name on it? Yes. Would I say them again? No." But others portrayed Lovell as a scientist caught in a web of conflicts that proved too lucrative, seductive, or both for him to disengage, if in fact he wanted to.

Lovell had come a long way. Back in 1993, when he and Maroon had

come up with the idea to measure the Steelers' brain functions, Lovell had started with just pencil and paper and 27 reluctant subjects. He had since refined that test and developed it for the computer. With financial backing from UPMC, the test was now being mass-marketed under the brand name ImPACT. Many brain scientists didn't consider ImPACT much different from the alphabet soup of neuropsych tests that were out there, such as ANAM, which was used by the Army, and NEPSY, which was designed for kids. But ImPACT, through its association with the NFL, had come to be known as the football concussion test, an impression that Maroon, Lovell, and Collins constantly encouraged.

By the mid-2000s, ImPACT had taken off. When the company was founded, Lovell's overlapping roles didn't draw much attention. But as the torrent of NFL papers continued, many researchers saw an obvious conflict. Lovell was overseeing the NFL Neuropsychology Program at the same time he was pushing ImPACT to NFL teams. The league's research helped him promote his company. Paper Number 12 read almost like an advertisement: "Many studies using the ImPACT have indicated that it is reliable and valid." Lovell's financial stake was disclosed in small print at the end of the paper. Soon, nearly every NFL team was using ImPACT. So was most of the NHL, which adopted mandatory neuropsychological testing in 1997. As concerns about concussions grew, the association with the NFL proved a gold mine for the company's marketers, who turned ImPACT into a Kleenex-like synonym for concussion assessment. Micky Collins, Lovell's brash protégé, became an ambassador and indefatigable marketer, hitting the road to promote both the research and the test behind it. "I've given a thousand lectures, two thousand lectures," he said, emphasizing that his primary focus was on concussion awareness and management. "I mean, I've been spending time away from my family because of it, educating and really promoting the data." By the end of the decade, with the national hysteria over traumatic head injuries peaking, over 90 percent of the high school trainers who used computerized testing to assess concussions were using ImPACT, according to the company. The test, which sold in kits for $350 to $750, had been translated into 17 languages.

Collins, like Lovell, went to great lengths to try to distance himself from the NFL committee. Within minutes of sitting down for an

interview in Pittsburgh, he declared: "First of all let's make this on the record: I wasn't involved in any of the NFL research, none. I just want to make sure you're clear on that. I'm not on any papers. I'm not on an NFL committee. I've never been on an NFL committee."

That was technically true. Collins had never had a direct role with the committee. But after a while it became hard, if not impossible, to figure out where the NFL ended and ImPACT began. A case in point was Pellman's pet project: the concussion-resistant superhelmet. After the early tests involving the crash-test dummies, the idea had been forgotten, buried under the avalanche of disputed research the NFL was cranking out. But the idea was very much alive. After the first biomechanical studies, Riddell, the NFL's official helmet maker, got to work designing the concussion-resistant helmet, which was based on specs that had come out of the NFL's research. For $500,000, Riddell even hired the Ottawa biomechanics firm, Biokinetics, that had performed the crash-test studies for the league.

Early on, the helmet project suffered a setback. In November 2000, Biokinetics sent a confidential report to Riddell warning that no football helmet—no matter how new and improved—could prevent concussions. That assessment confirmed what researchers such as Cantu and others had believed all along and essentially torpedoed Pellman's grand vision. The report, unearthed years later by *Frontline*'s Sabrina Shankman, went so far as to state that even if Riddell created a helmet that surpassed industry safety standards, there was still a 95 percent likelihood that a player would sustain a concussion from a strong enough blow. "No helmet can prevent a concussion. Full stop," Chris Withnall, the Biokinetics senior engineer who wrote the report, told Shankman.

Riddell built the helmet anyway, with Withnall's name on the patent. The company called it, ambitiously, the Revolution. Its principal defining features were flaps that extended over the lower jaw and additional protection around the ear hole. The NFL's video reconstructions had found that most concussions resulted from blows to the face mask, jaw, and side of the head. The Revolution's main selling point was that its design was based on research aimed at reducing concussions.

But how could Riddell make that claim after Biokinetics had privately warned that no helmet could prevent concussions? The answer

came in summer 2002, a few months after the Revolution was released. Collins got together with Thad Ide, Riddell's senior vice president for research and development. "For the record, I don't know who approached whom," said Collins. Together, they came up with an idea for a research project involving ImPACT, Riddell, and the University of Pittsburgh Medical Center. "Both Thad and I reciprocally thought it was a really good idea to do a study," Collins said. "Riddell was coming out with this new helmet technology. I'm not an engineer. All I know is that we could create a methodology that could study it."

The idea was to compare high school football players, some wearing the Revolution and others wearing their old helmets. The study would use ImPACT to determine recovery time after a concussion was diagnosed. Riddell provided the helmets and paid $75,000 to UPMC to subsidize the salaries of Lovell and Collins while they worked on the study.

The potential for conflict was obvious. Lovell was a member of the NFL's influential concussion committee. He was on record as saying the creation of a concussion-resistant helmet was "a fantasy," yet he had taken money from the NFL's official helmet maker to produce a study examining whether its new helmet reduced concussions.

Collins, who led the study, suggested that he was motivated in part by the need to bring in research dollars to justify his position at UPMC. "I needed money to fund my salary," he said. "I was going to get my ass fired, you know? So I'm looking for any kind of funding to do this research. Any struggling academic is looking for that. So that was part of it." He said he understood that Riddell probably was shopping for research that would support its claim that the Revolution reduced concussions. "I'm not an idiot; I know Riddell wanted the results to look good, okay?" he said. "I mean, obviously. I understand that. But I am one of the leading experts in concussion; I've done as much research as anyone. I can be trusted as an academic to do a good research project."

Lovell, Maroon, and Riddell's Ide were listed as coauthors. Although this paper would be published in *Neurosurgery,* the study was not technically part of the NFL series.

Not surprisingly, the study concluded that wearing the Revolution helmet reduced the "relative risk" of concussion by 31 percent and the "absolute risk" by 2.3 percent. The change in helmet design that grew

out of the NFL's research, Collins and his colleagues wrote, "appears to have beneficial effects in reducing the incidence of cerebral concussion in high school football players."

Riddell rushed out a press release:

> RESEARCH SHOWS RIDDELL REVOLUTION FOOTBALL HELMET PROVIDES BETTER PROTECTION AGAINST CONCUSSIONS
>
> *The study, which will be published in February's edition of* Neurosurgery, *found that athletes who wore the Riddell Revolution helmet were 31 percent less likely to suffer a concussion compared to athletes who wore traditional football helmets. The authors of this study estimate that the Revolution's patented technology could translate to 18,000 to 46,000 fewer concussions among the 1.5 million high school players who participate in football each season.*

Later, a UPMC spokeswoman provided e-mails that she said showed how the university had tried to prevent Riddell from misrepresenting and exploiting the research. The e-mails included Riddell's press release with proposed corrections. Riddell made a few changes, including striking the sentence, "There is now proof that one football helmet provides better protection against concussions." But most of the press release, including the banner headline, stood.

Cantu was still the section editor at *Neurosurgery* when the Riddell-funded Revolution study came across the transom. It seemed that his worst fears had been realized. Years earlier, Pellman had announced to the world that the NFL planned to create a concussion-resistant superhelmet. And now here was the result: a helmet that couldn't prevent concussions any more than any other helmet, created with the NFL's stamp of approval and peer-reviewed research that was funded and even coauthored by the company that planned to sell it to kids.

Cantu attached a blistering commentary to the study, suggesting that it failed to pass the "sniff test" and writing: "This article, in my opinion, suffers from a serious, if not fatal, methodological flaw."

That flaw was that the new Riddell helmets had been compared with random older models of indeterminate age.

Collins conceded that the varying ages of the helmets was "a major flaw" that skewed the results.

Years later, when asked about Cantu's criticism, Collins launched into a tirade that was very much of its time. "For him to criticize this study is a bunch of fucking bullshit," Collins said. "The flaws in this study were outlined. Everything was fair and balanced in that paper. And Cantu, he was part of the editorial staff! If he didn't want to publish it, why was it published? I have no problem with Bob wanting to reject the paper. There were serious flaws with the study, okay? I understand that. But when I picked up the paper for the first time and read the comments, I was like, 'Holy shit. Bob is ripping the shit out of me.' I'm like, 'Are you kidding me? Didn't pass the sniff test?' "

Micky Collins was a headstrong young researcher who once had admired Cantu as a giant in the field. "I was a young kid, and I respected the shit out of Bob Cantu," he said. But tests like ImPACT, which revealed an endless variety of concussions, had made Cantu's grading scales obsolete, Collins thought. "And guess what Bob did? Bob defended them until he looked like an idiot," said Collins. "Basically it was like an ugly death."

For his part, Cantu was still the King of Concussions. He had spent more time studying the injury than any researcher in the country. His voice carried a lot of weight.

But there was a larger issue beyond the debate over the Revolution helmet and the conflicts of interest and the competition between an older researcher and a younger researcher.

Collins, whether he acknowledged it or not, had aligned himself with the NFL, like Lovell, his mentor.

Cantu was a Dissenter.

That epic battle was building.

10

"THE LADY DOTH PROTEST TOO MUCH"

Not long after Omalu and Co. submitted their paper on Mike Webster to *Neurosurgery,* two things became clear. One was that the widely held view in some circles that *Neurosurgery* had been converted into a house organ of the NFL—the Official Journal of No NFL Concussions—was not entirely true. Apuzzo continued to rubber-stamp the NFL's research despite the mounting protests that it was flawed and self-serving. But now, in February 2005, he agreed to publish Omalu's paper as well. The publication of the Webster study set up competing narratives in the same medical journal: One said NFL players didn't get brain damage from football, and the other said they did. This development seemed to support Cantu's theory that Apuzzo more than anything was interested in topics that "sizzled" and boosted his readership. Whether Apuzzo had totally thought this through was unclear. The Webster paper would prove so hot that it ended up scorching almost everything it touched, especially the NFL.

That was the second thing: The big wet kiss Omalu had been expecting from the league would not be forthcoming. Instead, the NFL's doctors took out their scalpels and long knives. Omalu had gotten a hint of how controversial his study would be during the torturous review process, as he was asked to cleanse the paper of any suggestion that the

NFL's MTBI committee should have confronted the issue of long-term brain damage years earlier. An original version of the manuscript included a preamble detailing the history of the MTBI committee. It gave a summary of the retirements of Al Toon and Merril Hoge and stated that after Hoge's premature retirement, for the first time "NFL executives and medical personnel took notice of the possible neurodegenerative sequelae of professional football." None of that made the final draft.

The paper was published as a "Special Report" in the July 2005 issue of *Neurosurgery.* After a brief period of deceptive calm, Omalu received a call from a man who identified himself as Donald Marion, a member of *Neurosurgery*'s editorial board. Marion told Omalu that doctors from the NFL's MTBI committee were calling for his paper to be retracted.

"You know what that means, what that would mean to your career?" Marion said.

Omalu knew. He sat down and wept. He knew that in the world of scientific research, a demand for a retraction was the nuclear option. It generally was reserved for allegations of fraud, plagiarism, or cheating.

"But I haven't done anything wrong," Omalu pleaded.

Marion said that he had been asked by Apuzzo to mediate the dispute. He told Omalu that he would receive a copy of the NFL's demand and that he should confer with his coauthors to put together a response. That evening, Omalu e-mailed DeKosky and Hamilton, summarizing the conversation.

Omalu indicated that he had the impression Marion believed the demand was without merit and might have been directed by the league office. "Interestingly he thinks their paper is laughable and politically motivated," Omalu wrote to his colleagues. "He has asked me, however, to write up a very simple scientific explanation without becoming political. He said they all know that it was the NFL that may have instructed Dr. Pellman and his group to pen the commentary."

Despite Marion's reassurances, Omalu was terrified. As he prepared to read the NFL's letter at his Pittsburgh apartment, he poured himself a shot of Johnnie Walker Red and gulped it down. The letter was signed by the three leading members of the MTBI committee: Elliot Pellman, Ira Casson, and Dave Viano.

"We disagree with the assertion that Omalu et al.'s recent article

actually reports a case of chronic traumatic encephalopathy in a National Football League (NFL) player," the letter began. "We base our opinion on two serious flaws in Omalu et al.'s article, namely a serious misinterpretation of their neuropathological findings in relation to the tetrad characteristics of chronic traumatic encephalopathy and a failure to provide an adequate clinical history.

"These statements are based on a complete misunderstanding of the relevant medical literature on chronic traumatic encephalopathy of boxers (dementia pugilistica). A review of the relevant medical literature, including that cited by Omalu et al., in the chronological order in which it was published demonstrates the flaws in Omalu et al.'s assertions."

As Omalu read on, he began to relax. "By the time I got to the third paragraph I smiled," he recalled. "I even laughed. I knew that Pellman, Casson, and Viano did not know the subject and that their letter was embarrassing and shameful. I said to myself, 'Isn't it un-American?' I respect this country, I'm a foreigner, but I came here to chase my dreams, that the three doctors who are the heads of the NFL Brain Injury Committee don't even know the basic science of brain damage. I became angry."

The letter was six pages long, longer even than the original paper, much of it a scientific overview of the history of CTE in boxers. Pellman, Casson, and Viano used phrases such as "complete misunderstanding," "completely wrong," and "completely lacking." They made two primary arguments: that Omalu et al. had a case that didn't meet the criteria for CTE and that there wasn't enough clinical evidence showing Webster was mentally impaired. They insisted Omalu's findings met only one of the four standards necessary to call this CTE even though Omalu and his colleagues had never claimed this was identical to what was found in boxers. The NFL doctors suggested that the clinical history on Webster was essentially useless because it had been limited to a few phone calls with family members. They pointed out that Webster had no history of concussions or any indications that he had ever left a game because of a blow to the head.

"Omalu et al. go on to state that 'there was no known history of brain trauma outside professional football.' In fact, there was no known history of brain trauma *inside* professional football," they wrote, suggesting

that during his 17-year career in the NFL there was no evidence that Webster's brain was so much as jostled.

Casson, Pellman, and Viano suggested alternative theories for what might have happened to Webster's brain, theories that the league would continue to cite for years: alcohol, steroids, possible drug abuse. Ironically, the theories were reminiscent of those proposed by defenders of boxing after Martland, like Omalu a medical examiner, described Punch-Drunk Syndrome in boxers in 1928.

"We have demonstrated that Omalu et al.'s case does not meet the clinical or neuropathological criteria of chronic traumatic encephalopathy," they wrote. "We, therefore, urge the authors to retract their paper or sufficiently revise it and its title after more detailed investigation of this case."

It was signed:

IRA R. CASSON
ELLIOT J. PELLMAN
DAVID C. VIANO
New York, New York

The doctors didn't identify their connection to the NFL, as if they were merely independent physicians who had banded together in their outrage.

Omalu wondered about their backgrounds. He did some quick research and had to laugh: Pellman, the committee chairman and now one of Omalu's main critics, was a rheumatologist. The head of the NFL's brain committee was an arthritis expert?

When he finished, Omalu e-mailed Hamilton and DeKosky. "To say the least, it is a laughable commentary," he wrote.

Hamilton wasn't at all amused. "I read over their critique and I do not think it is laughable. . . . It is very serious indeed," he responded. Hamilton was more confident than ever about the validity of their research; the criticism was baseless, he felt. What concerned him was the NFL's attempt to erase their work from the record. He thought it was the work of a self-interested corporation trying to censor his independent research. "I like to think of them as being honorable scientists who are

simply stating an alternative hypothesis, but the fact that they wanted me to trash the paper and say that it was bad science, that cued me in to that they were kind of, oh, setting up walls," he said. "Trying to set up a barrier. To shut it off. To try to make sure that everybody knew that these Hamilton and DeKosky, Wecht, Omalu characters were just insane."

Over the next couple of weeks, the men exchanged e-mails discussing the main points of their defense: Webster's brain had widespread neurofibrillary tangles in several areas that "for a 50-year-old, are very very 'unnatural' "; that although Webster suffered other ailments, none was consistent with the presence of these tangles; that the boxing papers the NFL cited—in particular Corsellis's seminal research—also lacked detailed clinical histories; that the pattern of the tangles—throughout the cortex but nowhere in the hippocampus—is significant in that it signaled neurodegenerative disease inconsistent with Alzheimer's or other known disorders.

Hamilton wrote in one e-mail to his colleagues: "Without any clinical history, most neuropathologists familiar with dementing disorders would ask: did this patient engage in boxing? So when told that he played football, I think most would say, 'Yeah, OK.' "

Of course, there were no neuropathologists on the NFL committee.

Omalu, Hamilton, and DeKosky also dug further into the history of Webster's life after football. The NFL had blistered them for the limited clinical information documenting his mental illness, describing it as "completely lacking." Omalu and his colleagues discovered that just a few months earlier a federal judge had awarded Webster's family $1.8 million in a lawsuit against the NFL's disability board, which had compiled testimony from five doctors who concluded that Webster had brain damage.

"Their comments about us not having the detailed clinical history is stunning in its hypocrisy," DeKosky wrote in an e-mail to Hamilton.

As the group prepared its response to the NFL, Omalu knew he had another secret weapon that he thought would blow the NFL's protestations out of the water: He had discovered another case of CTE in a dead football player.

* * *

On June 7, 2005, Terry Long killed himself by drinking antifreeze. Long had played eight seasons in the NFL for the Pittsburgh Steelers, lining up alongside Mike Webster for five of those seasons in the mid-1980s. In some ways, Long was like Webster: an undersized hulk who bulked up through weight training and steroids. Long was 5-feet-11, at least 280 pounds, "half-crazy," as one former Steelers employee described him. At the same time, Long had a bighearted personality that drew him close with the Rooney family and his coach, Chuck Noll, whom Long viewed as a father figure.

After graduating from high school, Long enlisted in the military and served two years with the Special Forces Unit of the Army's 82nd Airborne Division. He played football at Fort Bragg—"I hated the military but loved playing football," he later said—and earned a scholarship to play at East Carolina. There he was designated "Strongest College Football Player in the Nation" after squatting, bench-pressing, and dead lifting a combined 2,203 pounds at the North Carolina State AAU Powerlifting Championships. He had a 40-inch waist, a 54-inch chest, 21-inch arms, a 20-inch neck, and 30-inch thighs. He ran the 40-yard dash in 4.8 seconds.

Long was an All-American at East Carolina and was selected by the Steelers in the fourth round of the 1984 draft. He played in 105 NFL regular-season games and 4 playoff games. In his final season, 1991, he tested positive for steroids at the beginning of training camp. When Noll told him, Long wept. The next day, he tried to commit suicide, first by sitting in a running car inside a closed garage and then, when that attempt was foiled by his girlfriend, by eating rat poison.

Like Webster's, Long's life after football was a dramatic downward spiral marked by bouts of depression and mood swings as well as a series of bad business decisions that led to financial problems. In 2003, a chicken- and vegetable-processing plant he owned was destroyed by fire. Two years later, on March 29, 2005, he was charged with setting the fire to collect $1.1 million in insurance, and he filed for bankruptcy that same day. Long also was accused of defrauding the state of $1.2 million in a separate business scheme. Soon afterward, he again tried unsuccessfully to kill himself, this time by drinking a bottle of Drano.

A little over two months later, Long's body lay in the Allegheny

County coroner's office—another dead Pittsburgh Steelers offensive lineman who had essentially lost his mind.

In the years to come, Pittsburgh brain researchers would sit back in wonder at the string of events that turned their city into "Ground Zero" for the NFL's concussion crisis, as the *Post-Gazette*'s Chuck Finder put it. First, Noll's offhand remarks to Maroon in 1991 about the lack of quantifiable evidence for a concussion, which led to the development of ImPACT and one of the most successful concussion research institutions in the country at UPMC. Then Webster, his condition diagnosed by the young Nigerian pathologist who happened to be working that day. This time, Omalu wasn't on call. The autopsy was performed by Abdulrezak Shakir, Omalu's Iraqi colleague, who had worked in the coroner's office for 17 years. It is not common practice to save the brain during a forensic autopsy; after being weighed and examined, the vital organs usually are sewn into the body cavity. But Shakir, thinking about Omalu's research, preserved Long's brain for his colleague.

Omalu repeated the process he had followed with Webster. When the tests came back, he had "Chronic Traumatic Encephalopathy in a National Football League Player: Part II." Omalu sent the slides to Hamilton, who responded with an e-mail: "I have looked over your new NFL case. Fantastic! It is classic 'dementia pugilistica,' at least according to the entire chapter in Esiri and Morris (I will copy for you)."

This time, Wecht, the celebrity pathologist, wasn't interested in waiting for a medical journal to publish the findings. He went straight to the media with the news: Terry Long had sustained brain damage from playing football.

Shakir's autopsy report left no room for doubt: Long's brain damage had been caused by "repeated mild traumatic injury while playing football." The brain, Wecht said, showed signs of meningitis—inflammation—that stemmed in part from all the blows Long had taken playing football.

"A football helmet gives you an awful lot of protection," Wecht said. "But you don't have to be a doctor or an engineer or even a football player to realize that the helmet does not block out all the measured force produced when some 300-pound player with a hand the size of a

Christmas ham whacks you in the head dozens of times a game, season after season."

The NFL responded swiftly. This time the league's defender was Maroon, who had been the Steelers' neurological consultant during Long's career. "I think the conclusions drawn here are preposterous and a misinterpretation of facts," he told the *Post-Gazette*. "To say he was killed by football, it's just not right, it's not appropriate. I think it's not appropriate science when you have a history of no significant head injuries."

Maroon said Long's only recorded head trauma was from a 1990 car accident when he swerved to avoid hitting a deer. "I was the team neurosurgeon during his entire tenure with the Steelers," Maroon said. "I rechecked my records; there was not one cerebral concussion documented in him during those entire seven years. Not one."

Maroon cited Long's previous suicide attempts and his steroid use as other possible causes. "The bottom line is, in a patient who has not had truly documented head injury, no evidence of concussions—I would have seen him if he had—who has had a history of substance abuse, a history of suicide attempts with extremely neurotoxic materials, and then to conclude that this brain was damaged from football is more than a long stretch," he said.

Wecht knew Maroon well—his son Danny was a neurosurgeon in Maroon's practice and often worked the sidelines with the Steelers—and he became concerned by the aggressive denials. Wecht called Omalu at home.

"Bennet, are you sure?" Wecht asked.

"Cyril, if Terry Long did not have CTE, may I drop dead tonight," said Omalu.

Wecht ordered Omalu to speak to the media. Omalu, as it turned out, had Long's medical records, including those from the Steelers. They included a 1987 letter written by Maroon describing a concussion Long had suffered after colliding not with a deer but with an opposing player. Maroon wrote that Long was light-headed, had difficulty concentrating, and walked unsteadily. He recommended that Long sit out a week. Omalu told the *Post-Gazette* those symptoms were consistent with "massive concussive injuries."

One day earlier, Maroon had insisted that Long had not had a single

concussion from playing football. Now he had to admit that he had "overlooked" the letter. But he said a concussion like Long's "happens in the NFL on a weekly basis." He said it was still a stretch to link Long's death to football. Pellman rushed to Maroon's defense, calling Omalu's conclusions "speculative and unscientific."

The Long case became even more confusing when a toxicology report came back and revealed that the swelling in Long's brain had been caused by the antifreeze he had ingested and not by football, as Wecht had told the media. When the toxicology report came back, Wecht had quietly changed the cause of death on the autopsy report to "suicide." Omalu was unfazed. The presence of neurofibrillary tangles was consistent with CTE, which, he said, could only have been caused by football. "People with chronic encephalopathy suffer from depression," Omalu said. "The major depressive disorder may manifest as suicide attempts. Terry Long committed suicide due to chronic traumatic encephalopathy due to his long-term play." Omalu added, "The NFL has been in denial."

"I think it's fallacious reasoning," Maroon shot back, "and I don't think it's plausible at all."

While the Long dispute played out, Omalu, Hamilton, and DeKosky put the finishing touches on their response to the NFL's demand for a retraction of the Webster paper. Not surprisingly, Omalu's initial response had been emotional. He called the NFL's reasoning "archaic" and "naive" and accused the MTBI committee of "ignoring possible long-term neurodegenerative outcomes of play in the NFL" for over a decade. Omalu described his reaction as "a typical manifestation of an Igbo man: 'Who do you think you are? Who do you think you are fucking with? C'mon, bring it on!' "

DeKosky wanted something more measured. "Ron, I don't want anything to do with this preachy polemic," he wrote in an e-mail to Hamilton. "The only way to respond to THEIR polemic is with a short, fact-based response."

Hamilton agreed to play editor and dial it back from the original Igbo. He stripped out Omalu's indignation and reduced the letter to two pages, although he did allow himself one bit of amusement, beginning the response to the NFL with a quote: "The lady doth protest too much, methinks" (Shakespeare, *Hamlet* III, ii).

That, too, was cut out of the final version, which was published in the May 2006 issue of *Neurosurgery,* alongside the NFL's demand for a retraction. Omalu, Hamilton, and DeKosky wrote that they had not suggested that Webster's brain was identical to that of a punch-drunk boxer. Boxers endure more severe head trauma, they wrote, largely because they don't wear helmets. "We doubt Casson et al. really feel that NFL offensive linemen do not experience repeated episodes of head trauma," the letter said. "It is far more likely that the majority of the head trauma in the NFL, as well as in American football in general, is underreported by the players and the team staff, who accept the occasionally 'dazed' recovery during the game and postgame headaches simply as part of the sport, not unlike bruises and sprains." They reminded the NFL's concussion committee that Webster's brain damage was well known in the league. "Of course, the NFL, at least the Disability Plan, acknowledged the cognitive impairment and its relationship to his profession," they wrote.

In conclusion, they wrote, "Our case is important primarily because it indicates there may be brain damage in NFL players that is currently under-reported." They said the NFL needed to begin a long-term study and they would be "happy to collaborate."

Left unsaid was the self-evident fact that the NFL's demand for a retraction had been denied. The Webster paper stood.

When Apuzzo and *Neurosurgery* published the Long study six months later, the NFL kept up its attack. The diagnosis of CTE was still wrong. Football players didn't get brain damage.

The public brawl was taking a toll on Omalu. The young Nigerian immigrant who had barely heard of the NFL suddenly found himself the target of some of the most powerful doctors in the country, who had the full weight of a rich and powerful corporation behind them.

One afternoon, the phone rang at Omalu's desk at the coroner's office. Omalu thought twice about answering. He was never sure who might be calling these days and what might happen next. But he picked up.

"Hello, is this Bennet?" said a baritone voice with a slight drawl.

"Yeah."

"This is Julian Bailes. I'm the chairman of the Department of Neurosurgery at West Virginia University."

"What can I do for you?"

"Bennet," said Bailes. "I believe you."

In Omalu, the Dissenters had found an ally. In many ways, his discovery was a validation of their own work. Bailes and Guskiewicz had found a large number of players with signs of dementia. Omalu and his colleagues had taken it a step further, confirming neuropathological changes in the brains of two players who were mentally impaired at the time of their deaths. Yet the NFL had dismissed Omalu, Hamilton, DeKosky, and Wecht in the same way the league's doctors had dismissed Bailes and Guskiewicz. The Dissenters found it appalling. Their concern was no longer whether this was a problem; it was how many players like Mike Webster and Terry Long were out there: walking time bombs who were a danger to themselves and a nightmare to the people who cared about them.

Bailes told Omalu he wanted to help any way he could. Cantu also threw his support behind him. One day, Omalu received an e-mail from a man who identified himself as one of Cantu's former patients. His name was Chris Nowinski, and he told Omalu he wanted to interview him about his work for a book he was writing about the concussion crisis. They arranged a time to chat, and during the 45-minute conversation, Omalu educated Nowinski on CTE and his certainty about its significance. He also talked about the NFL's hostile reaction to his research.

Nowinski soaked it up. He was a new breed of Dissenter: not a research scientist but a concussion activist, for lack of a better term. He was trying to create public awareness of the underreported problem. Nowinski was tall, blond, and preppy, a former Harvard lineman and pro wrestler who became interested in concussions as a result of his own painful fieldwork. At the time, Nowinski was just 27, but he had been bashed in the head for years. Nowinski had played football at John Hersey High School in Arlington Heights, near Chicago, starting out as a spindly 6-foot-3, 160-pound middle linebacker. He loved the sanctioned violence and macho culture. Nowinski played with a broken hand, gulped down ibuprofen to fight through an injured shoulder, lived for the big hit. In one game, he sprinted down the field on punt

coverage and knocked out the returner with a helmet-to-helmet hit. Nowinski stood over his opponent and played to the crowd. He lifted weights constantly. By the time he graduated, Nowinski was a 6-foot-5, 230-pound defensive end. He also was an excellent student—in junior high, he was the Illinois champion in the Scientific Olympiad in the map-reading category—and a budding actor, performing in *West Side Story* in high school.

Nowinski's successful career at Harvard was marred by at least a couple of concussions, though they weren't diagnosed at the time and he didn't miss any action. Once, during an intrasquad game, he collided so hard with a teammate that they both fell down sideways, toppling like bowling pins. "That was the first time I remembered the sky turning orange," he said.

By his senior year, Nowinski was 6-5 and 295 pounds and harbored dreams of playing in the NFL. He worked out for a handful of teams, but when it became clear he wasn't going to make it, Nowinski began to focus on life after football. Although he had majored in sociology, Nowinski landed an internship at Trinity Partners, a Boston-area consulting firm. One of his bosses, John Corcoran, was a pro wrestling fan. He knew Nowinski had a background in sports and theater and also loved the spectacle of pro wrestling. Corcoran suggested that he try it. It turned out to be a perfect fit, a chance for Nowinski to combine his athletic skills with his acting bug.

After work, Nowinski spent his evenings training at Killer Kowalski's Pro Wrestling School in Malden, Massachusetts, founded by the fabled wrestler who mentored some of the sport's future stars, including Triple H, Big John Studd, and Chyna. Nowinski made $20 in his first match, wrestling under the name Jake Champski in front of 150 people at an armory in Portland, Maine. He then put together a video application that earned him a spot on an MTV wrestling reality show, *Tough Enough*. The writers dubbed him Chris Harvard, creating a character fans would love to hate: the snobbish Harvard graduate who taunted his opponents with his superior intellect. Nowinski repurposed a chant he recalled hearing from the fans of an opposing high school back in Illinois: "Five, ten, fifteen bucks, we own the company, you drive the trucks!" In 2002, he was signed by the WWE and made his debut on

Monday Night Raw, with 5 million people watching. He was a rising star.

"I played the hateable character very well," he recalled. "I had, you know, they liked to use the term 'natural heat.' People just liked to dislike me."

Chris Harvard wore tight crimson trunks with the school logo on his butt. Sometimes he recited poetry to incite the crowd. At one match in Moncton, New Brunswick, he shouted:

Roses are red,
Violets are blue,
The reason I'm talking so slowly
Is because no one in Moncton has passed grade two.

Nowinski, of course, knew that the sport was staged, that the moves and the results were choreographed. But there was no way to comprehend the true violence of pro wrestling until he was in it. "You don't appreciate how the sausage is made," he said.

Nowinski got kneed, elbowed, drop-kicked, punched, and otherwise smashed in the head. That was all very real. The concussions began with a kick to the chin from Bubba Ray Dudley's boot. Nowinski sucked it up and kept going. When more concussions followed, he never gave himself time to recover. Soon he was experiencing pounding headaches and blurred vision; sometimes he forgot how his matches were supposed to play out, like an actor forgetting his lines. He began sleepwalking. One night his girlfriend woke up at a hotel in Indianapolis and saw Nowinski standing on the bed, trying to climb the wall. She tried unsuccessfully to wake him by shouting his name, only to watch him leap off the bed and slam headfirst into the wall.

After that, Nowinski set out on a journey to try to figure out what was going on inside his head. He visited a series of head trauma experts, including Lovell at UPMC, but never felt that he truly understood. Finally, he was referred by a friend to one of the world's leading concussion experts, a doctor right in his own backyard. It was Cantu, one of the original Dissenters. Nowinski had found his savior, a man who took the time not only to define concussions for him but to explain how poorly

understood they were and the dangers of not allowing them to heal. The two met many times over the coming months, and Cantu became more than Nowinski's doctor; he became his mentor, his teacher, his friend, and his champion. It was Cantu ultimately who encouraged Nowinski to write the story of his concussions, to help educate the world. Cantu saw "a dynamic individual, a very brilliant mind, whose background is 180 degrees from mine. He had lived reality TV life. He had lived the star athlete life. And he knew how to use the media to get across ideas in a way that, duh, never occurred to me in 30 years of writing papers. Reminds me of the monk in the monastery approach, as compared with what can happen instantaneously if you get that message out."

"Medical guys write books all the time, but no one reads them," Cantu told Nowinski. "You have a platform from wrestling."

As Nowinski began his work on the book, Cantu directed him to other research scientists and some of his other patients. Nowinski also reviewed the literature on concussions. That was how he came upon Omalu. Nowinski's book, *Head Games: Football's Concussion Crisis,* was published several months later, with an introduction by former professional wrestler turned governor Jesse "the Body" Ventura. Nowinski's dedication read: "To the players, young and old, whose lives have been changed forever by head injuries."

On November 20, 2006, Nowinski was checking SI.com when he read that the 44-year-old Andre Waters, a former Philadelphia Eagles safety, had committed suicide by shooting himself in the head. Nowinski remembered that Waters, nicknamed "Dirty Waters," had a reputation as one of the hardest hitters in the game. Waters had spent 12 seasons in the NFL. In 1994—the NFL's Year of the Concussion—he had told the *Philadelphia Inquirer* that he had tried to count how many concussions he sustained during his career and lost count at 15. His treatment? "I just wouldn't say anything," he said. "I'd sniff some smelling salts, then go back out there."

Reflecting on Omalu's work, Nowinski played a hunch. He contacted Dr. Leszek Chrostowski, the associate medical examiner in Tampa, where Waters had killed himself. Nowinski explained who he was and asked Chrostowski if he was aware of the literature connecting

concussions and depression. He then politely made an unusual request: Could he please obtain what remained of Andre Waters's brain for further study?

"He said, 'There's no evidence that there's any connection,' " Nowinski recalled. "He kind of implied that I was crazy to think so."

Nowinski sent the medical examiner Omalu's paper as well as the studies done by Bailes and Guskiewicz for the Center for the Study of Retired Athletes. He then called Omalu to tell him about Waters.

"If I can get you another brain, would you study it?" Nowinski asked.

"Absolutely," said Omalu.

Omalu called Chrostowski to support Nowinski's efforts. The medical examiner agreed to give them the tissue if they could get permission from Waters's family. Omalu told Nowinski he wanted no part of calling the family, and so Nowinski's career as a brain chaser was launched. It was the hardest assignment imaginable. He would have to cold-call the family members of somebody he didn't know who had just put a gun in his mouth and pulled the trigger. Nowinski wrote up a script, closed the door to his room, and practiced for half an hour.

"The most difficult cold call I've ever been part of," he said.

Nowinski spoke with one of Waters's sisters, describing his own experiences with concussions and the cases of Mike Webster and Terry Long, raising the possibility that her brother might have had the same terrible disease. The family agreed. Despite the bullet wound, enough tissue had been recovered from Waters's brain for Omalu to examine it. The medical examiner sent the tissue to Omalu in Pittsburgh.

Nowinski began to prepare for the possibility that Waters might have CTE. He thought it would be huge news, a third documented case of a former NFL player diagnosed with brain damage after dying tragically. He didn't want to wait for the slow wheels of science to turn—the publication of yet another peer-reviewed paper—before word got out. He wanted people to know. "There were people that were going to kill themselves between now and then because they didn't know what was happening to them," Nowinski said. "And there were kids who were going to play through concussions because they didn't know that it mattered. And to have something with this sort of public health implication

sitting on a shelf for a year when you know it's true, and it's the third case of three, was to me impossible."

While trying to get his book published, Nowinski had been introduced to a New York–based freelance journalist named Alan Schwarz. Schwarz had been encouraging: He told Nowinski that his book was well written and thoroughly researched. Schwarz then pointed him to a literary agent and a couple of prospective publishers. Schwarz had no particular expertise in concussions; he was primarily a baseball writer, an expert on statistics who had graduated from the University of Pennsylvania with a mathematics degree. Schwarz described himself as "an accidental journalist." He had decided to become a sportswriter only after learning that he needed a master's degree to teach high school math, his longtime ambition. Schwarz had recently published his own book: *The Numbers Game: Baseball's Lifelong Fascination with Statistics.* Now Nowinski called Schwarz again, thinking perhaps he could help with the Waters story.

"I think I have something good," Nowinski told Schwarz. "I think I have something important. But I'm not sure what to do with it. And you're the only one who ever took me seriously."

Schwarz, then 38, had a developing relationship with the *New York Times.* He had written some baseball stats columns and a few front-page stories, including a profile of a 111-year-old former Negro League player who was living in St. Petersburg, Florida. Schwarz told Nowinski he would try to set up a meeting with Tom Jolly, the *Times*' sports editor. Nowinski traveled to New York for the meeting and explained the story and how he was awaiting the results of the analysis on Waters's brain. Schwarz thought he was there as the go-between, but Jolly told him as he was leaving that he would write the story on the Waters results.

Schwarz was excited, but he didn't immediately recognize it as big news. "I didn't necessarily have the keenest nose for news," he said.

Then, in January, the slides came back: Waters had brain damage. Omalu told Nowinski, who relayed the news to Schwarz. Schwarz contacted several experts for comment: Cantu, Bailes, Guskiewicz—most of the Dissenters—and members of the NFL's concussion committee. Guskiewicz told him: "I think that some of the folks within the NFL

have chosen to ignore some of these earlier findings, and I question how many more, be it a large study like ours, or single-case studies like Terry Long, Mike Webster, whomever it may be, it will take for them to wake up." Schwarz didn't know what he was getting into. He figured he would write the story and move on. "I thought it was going to be one story and that was it," he said. "You know, you do a story on this thing, and then you get back to writing about baseball."

When he drafted the piece, Schwarz focused on Nowinski's compelling life story and how he'd gotten possession of Andre Waters's brain. It was basically a human interest story about a concussed former wrestler turned activist. Late in the day, after the story had passed through the news desk, Schwarz was told to rewrite the top to get straight to the heart of the matter: "Since the former National Football League player Andre Waters killed himself in November, an explanation for his suicide has remained a mystery. But after examining remains of Mr. Waters's brain, a neuropathologist in Pittsburgh is claiming that Mr. Waters had sustained brain damage from playing football and he says that led to his depression and ultimate death."

"The beginning was restructured at the last second because the *Times* had a better idea of what news was," Schwarz said. "I knew what a feature was, and I could do a pretty good feature. But they recognized what this could be."

The story ran on page 1 of the *New York Times* on January 18, 2007. That was the day the NFL's concussion problem hit the mainstream. The story had been percolating for over a decade, from Greg Garber's ESPN piece on players such as Toon and Hoge back in 1994, to Peter Keating's powerful *ESPN The Magazine* story in 2006 about Pellman's dubious reign as head of the concussion committee ("Dr. Yes"), to Wecht's public announcement in Pittsburgh that Terry Long had brain damage.

But the *New York Times* had elevated the story by virtue of being the *New York Times.*

"Without the *Times,* it never moves," Nowinski said. "It cannot be overstated how important it was."

• • •

When Bailes contacted Omalu—"Bennet, I believe you"—he explained that he had been asked by the American Association of Neurological Surgeons to see if he could examine Omalu's research. Omalu readily agreed. Bailes thought the meeting also presented a huge opportunity to bring the NFL into the fold. The denials could go on for only so long before the league had to act, he thought. Bailes decided to invite his former boss, Maroon, to the session. Despite Maroon's harsh criticism of Omalu, Bailes thought he was a serious, reasonable man and would respond to evidence.

By that time, Omalu and Maroon had struck a truce. Omalu had gone to visit the distinguished neurosurgeon in his office at UPMC, and the two had talked it out after Maroon's "fallacious reasoning" comment in the *Post-Gazette.* Omalu, in fact, had proposed making Maroon director of a longitudinal study of CTE in retired players that he, Hamilton, and DeKosky were planning to propose to the NFL. Omalu, like Bailes, felt the NFL would eventually have to come around. In an e-mail to Hamilton and Hamilton's boss, Clayton Wiley, Omalu attached a copy of the proposal and wrote: "I intentionally suggested that Dr. Maroon should be the Director of the project since the NFL will be more likely to fund the study if they know that their own man is at the helm of affairs and will be less likely to undermine them."

Omalu, Bailes, Maroon, Hamilton, and DeKosky gathered in Hamilton's office on the fifth floor of the A Wing at UPMC Presbyterian. Nearby was a conference room with a multiheaded microscope that would allow Bailes and Maroon to look at the slides while Omalu walked them through the material.

Omalu was nervous. It was one thing to write a paper, but the young Nigerian was about to present his findings to two of the top neurosurgeons in the country, Bailes and Maroon; an internationally recognized Alzheimer's expert, DeKosky; and Omalu's widely respected mentor, Hamilton. Bailes took pages of notes. He was struck by the magnitude of the moment, the potential significance to the game he had played and continued to love.

"To realize the implications and that we were on the very cutting edge of it, it's a very striking realization," Bailes recalled. "It was not going to be a fun journey."

Maroon hadn't said much throughout the meeting, but finally he asked Omalu: "Where do you think this is going?"

"To be honest, I don't know," Omalu said quietly. "But I think many, many more players have this disease than we have acknowledged."

"Do you understand the impact of what you're doing?" Maroon asked.

"Yes," Omalu said.

Maroon seemed to be coming to his own moment of reckoning. He had been with the Steelers for two decades. He had helped launch ImPACT, the neurocognitive test that raised awareness within football about the serious effects of concussions. But in recent years, as the debate grew, more often than not he had sided with the NFL, praising the committee's research and casting doubt on Omalu's findings.

Maroon asked Omalu again: "Do you really understand the impact of what you're doing?"

"Yes," Omalu answered.

The conversation continued, and Maroon asked Omalu one more time: "Bennet, do you *really* understand the impact of what you're doing?"

"Okay, what is the impact?" said Omalu.

Maroon tilted his head back.

"If only 10 percent of mothers in America begin to conceive of football as a dangerous game," Maroon said, "that is the end of football."

11

A MAN OF SCIENCE

Do you really understand? Suddenly, there were a lot of interested parties posing the exact same question. For years, really, the battle over the NFL's concussion policies had been confined largely to the pages of a medical journal and the few researchers who cared. People later forgot that the original Dissenters were a vociferous Gang of Four: Bob Cantu, Kevin Guskiewicz, Julian Bailes, and Bill Barr. (The superagent Leigh Steinberg was an honorary member, by virtue of his awareness campaign.) Within those circles, the NFL's scientific transgressions were certainly a big deal, a source of constant discussion and indignation. But very little of the dispute had seeped out into the real world. Now the number of people openly challenging the NFL was growing by the day. They included reporters from powerful media organizations, especially Alan Schwarz of the *New York Times* and Peter Keating of ESPN; Omalu and Nowinski; and a growing number of prominent former players.

Harry Carson, the New York Giants linebacker of 13 years, had been profoundly affected by Webster's death. He had flown to Pittsburgh to attend the funeral out of respect for his former opponent and had spent time talking to Garrett, who described in detail his father's horrific final years. Later, when Carson learned that Omalu had diagnosed Webster with brain damage, he was heartbroken. He partly blamed himself. Carson flashed back to the brutal tactics he had employed to try

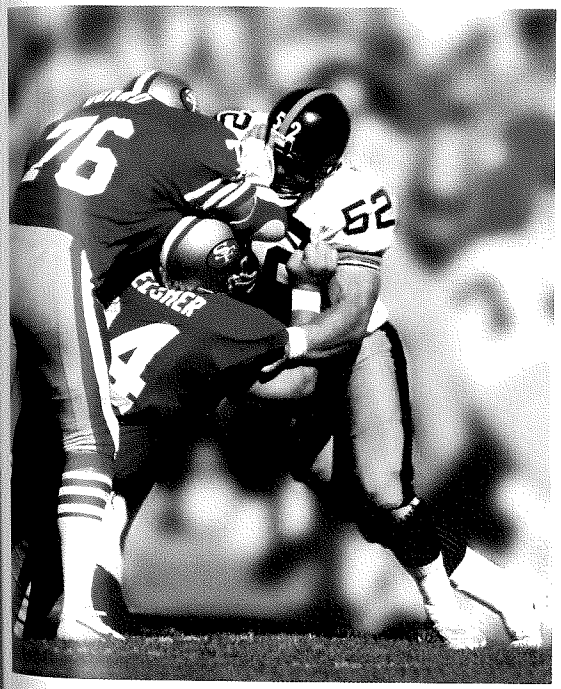
to neutralize Webster's incredible strength—how he gathered "all of my power from my big rear end and my thighs into my forearm," which he unleashed on Webster's head. "I'm the guy that he would fire off the ball to hit, and I would hit him in the face with my forearm, you know?" Carson said. "And so I was distributing the damage."

Carson was well positioned as a spokesman for the cause of former players, a distinguished, imposing man still built like granite. He combined the sensitivity of a Manhattan psychoanalyst with the naked violence of the Pit. "I wasn't known for getting my hands on the ball," he wrote in his autobiography, *Captain for Life,* "but I was known for knocking a player's dick in the dirt if he came my way and I got a good shot on him." When O. J. Simpson told Carson that no player had hit him harder, "that made my year," Carson wrote. Carson was so respected by his peers that coach Bill Parcells sent him out alone for the coin toss before the 1987 Super Bowl against the Broncos.

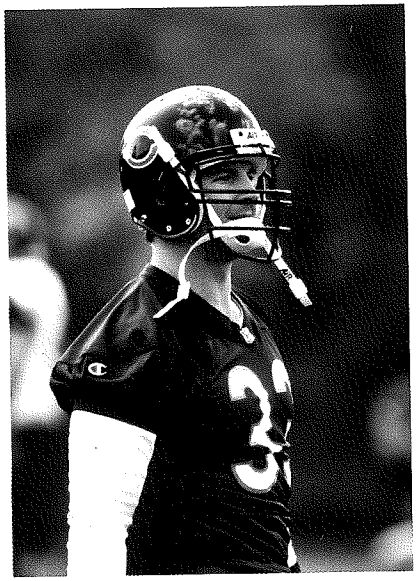
After his retirement in 1988, Carson had been open about his own struggles with depression. He confessed that he once considered driving his car off the Tappan Zee Bridge into the Hudson River. "I'd seen where there were people who would stop their car on the bridge and then jump off the bridge," he said in an interview for this book. "If you're on the Tarrytown side, there's a curve. And I was thinking, 'What if I accelerated, hit the guardrail, and go through?' " Carson found that there seemed to be no rhyme or reason to his moods; they simply came over him like squalls. Only after he went to a neuropsychologist and described his symptoms—migraines, mysterious twitching in his arms and legs, sensitivity to bright lights—did it begin to make sense. The neuropsychologist diagnosed him with post-concussion syndrome related to his career.

The diagnosis seemed to liberate Carson. It also awakened him to the devastation he recognized among many of his peers. Carson held a dark view about NFL-style capitalism, how it chewed up and spit out players. "When someone gets hurt, you just find another part," he said. "The reality is nobody gives a shit about those guys. I mean, their time is over. They don't bring anything of value to the table. Some people feel like they need to just shut up, go away and enjoy your retirement and that's it." Webster's death, he felt, had been a moment of shame for the

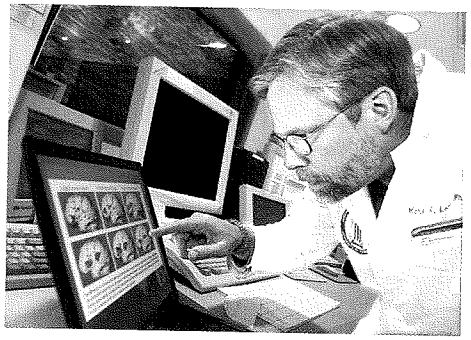
At the University of Wisconsin, Mike Webster began his transformation into "Iron Mike," obsessively driven by fear that he would never escape his tormented childhood.



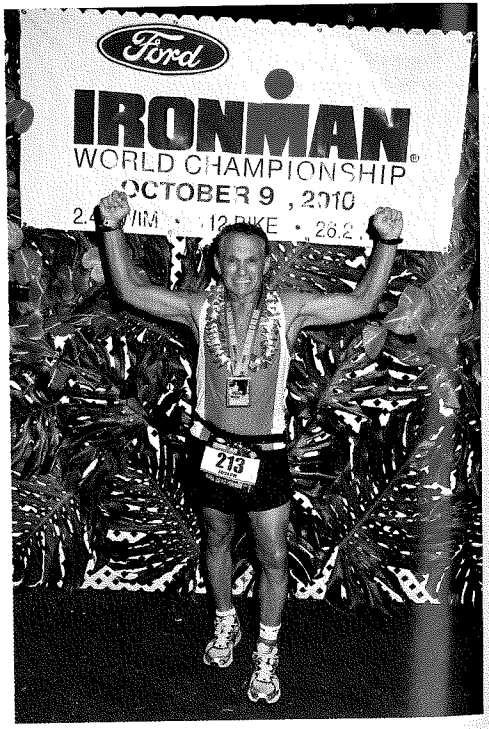
Webster played 17 seasons, winning four Super Bowls, becoming the strongest man in the NFL, and going six years without missing a single offensive play. But his struggles with mental illness would define his legacy as much as his Hall of Fame career.



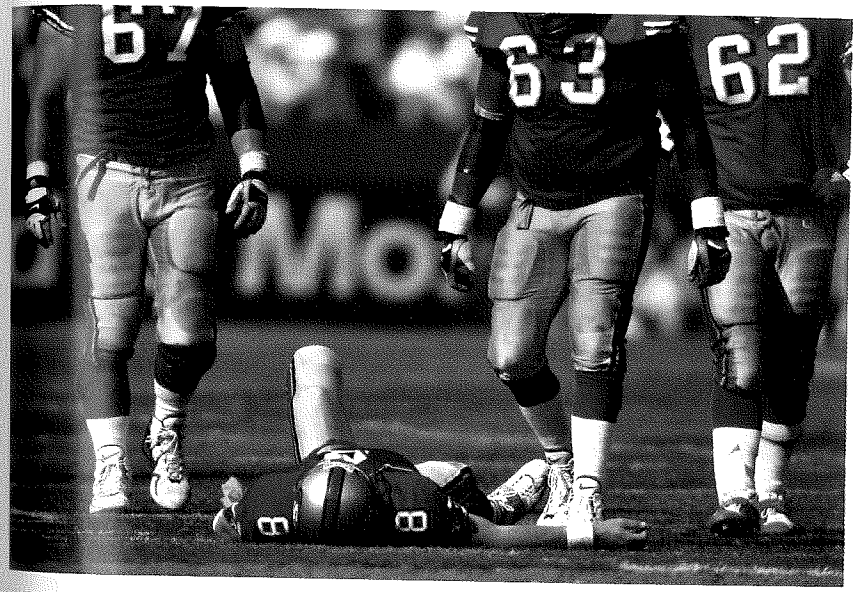
Merril Hoge retired at 29 after a concussion that left him unable to recall his daughter's name and briefly caused him to go blind. He sued the Chicago Bears doctor for negligence.



Mark Lovell, a neuropsychologist, cofounded ImPACT, a hugely popular concussion test, and was a charter member of the NFL's Mild Traumatic Brain Injury Committee. He later disavowed the committee's major findings.

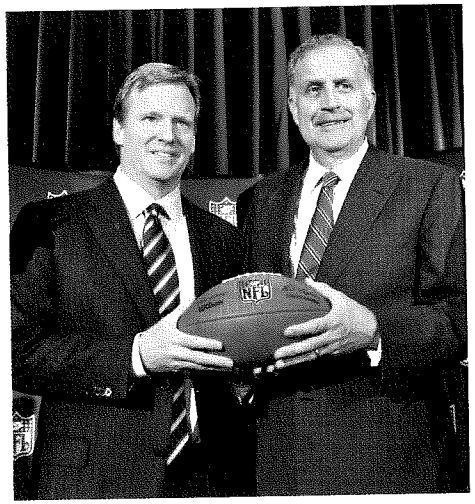


When confronted with the first cases of football-related brain damage, Joe Maroon, longtime neurological consultant to the Pittsburgh Steelers and a competitive triathlete, said, "If only 10 percent of mothers in America begin to conceive of football as dangerous, that is the end of football."

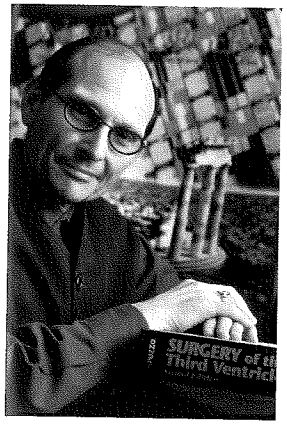


Steve Young insisted he was the "vanilla guy" whose concussions were routine, but his retirement after numerous head injuries forced the NFL to confront the growing crisis.

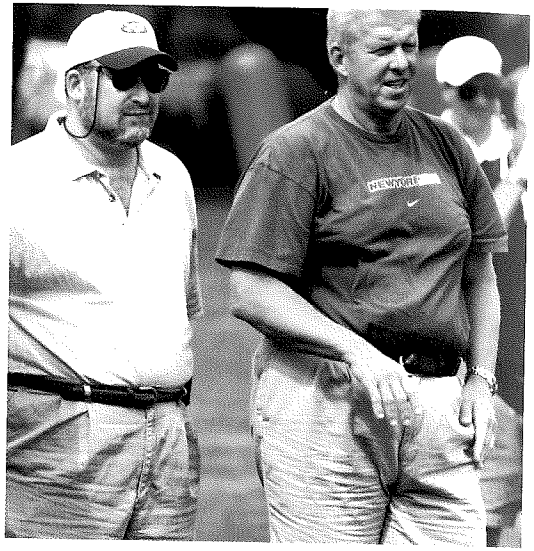
Superagent Leigh Steinberg represented practically every starting quarterback in the NFL; he ultimately became concerned that football might destroy the men who helped build his empire.



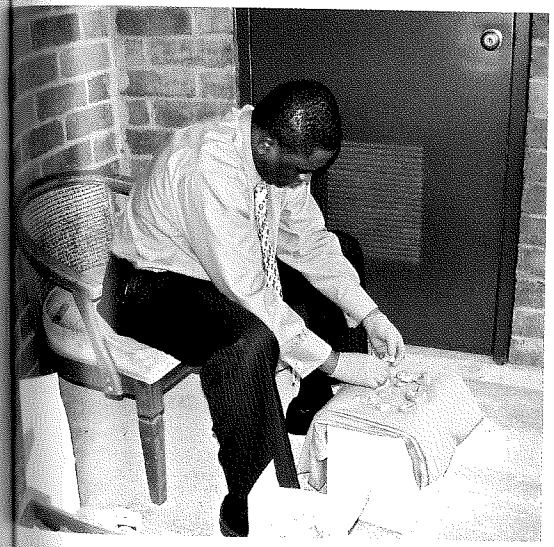
When he retired as NFL commissioner in 2006, Paul Tagliabue (right) dumped a health crisis and a public relations disaster in the lap of his former right-hand man, Roger Goodell (left).



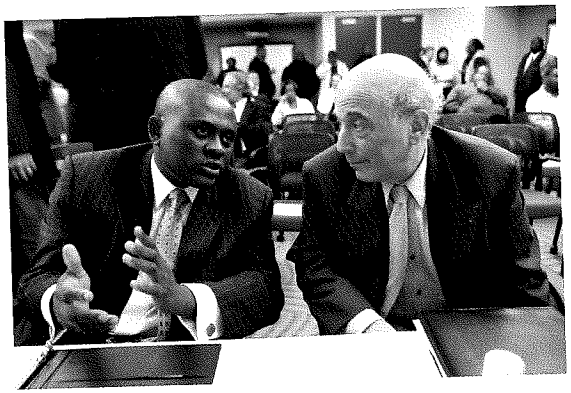
As head of the journal *Neurosurgery*, USC professor and New York Giants consultant Michael Apuzzo rubber-stamped the NFL's concussion research over the objections of peer reviewers, according to one of his editors.



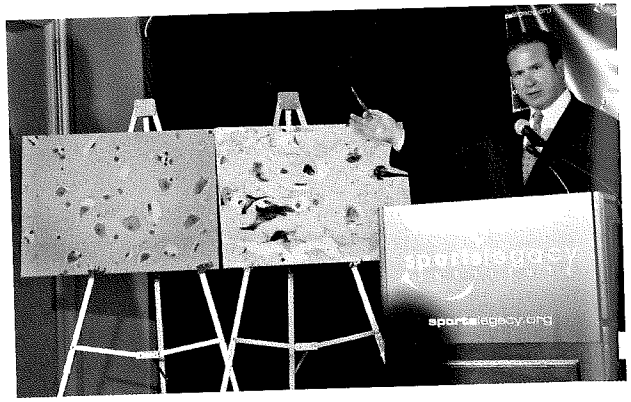
As Jets team doctor, Elliot Pellman (left), who also headed the NFL's research arm, sent severely concussed players back into games, sometimes under pressure from head coach Bill Parcells (right), according to former players.

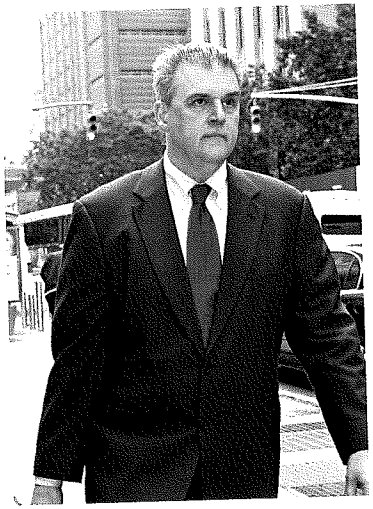


Bennet Omalu, the Nigerian pathologist who documented the first case of football-related brain damage, often conducted research on the porch or dining-room table of his Pittsburgh condominium.



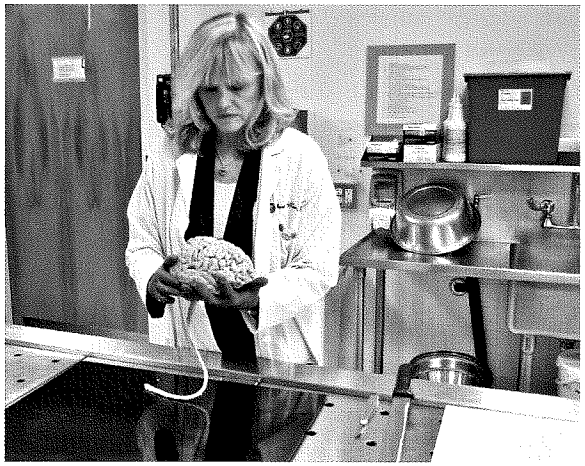
Five years after Ira Casson (right) and his colleagues sought to discredit Bennet Omalu and his research on football and neurodegenerative disease, the two men met for the first time at a 2010 congressional hearing in Detroit.



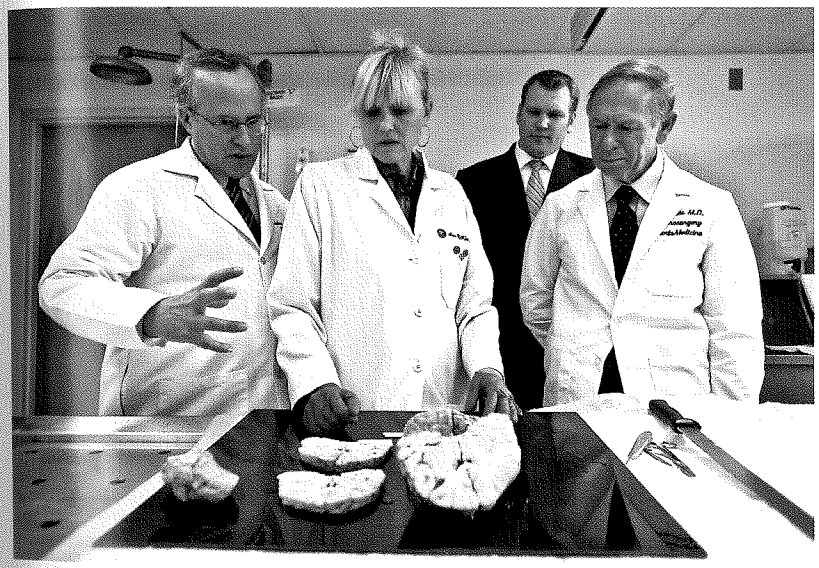


Above: Former Pittsburgh Steelers doctor Julian Bailes presented evidence linking football and brain disease to NFL officials, including Commissioner Roger Goodell, only to face mocking skepticism from the cochair of the league's concussion committee.

Left: Former New York Jets neuropsychologist Bill Barr accused the NFL of cherry-picking data to support its assertion that pro football players recovered quickly and completely from concussions.



Ann McKee, a Packers fan and charismatic neuropathologist, became the unofficial spokeswoman for CTE. She came to believe that "most NFL players are going to get this. It's just a question of degree."



The BU Group (left to right): Bob Stern, Ann McKee, Chris Nowinski, and Bob Cantu. After splitting with Omalu, Nowinski assembled a team that gained international recognition as the leading researchers on football-related brain damage.